PRO225 Series Stage

User's Manual

P/N: EDS134 (Revision 1.04.00)

Dedicated to the Science of Motion

Aerotech, Inc.
101 Zeta Drive,
Pittsburgh, PA, 15238
Phone: 412-963-7470
Fax: 412-963-7459
www.aerotech.com

Product Registration

Register online at: http://www.-aerotech.com/prodreg.cfm

Technical Support

United States Headquarters:
Phone: (412) 967-6440
Fax: (412) 967-6870
Email: service@aerotech.com

United Kingdom:
Phone: +44 118 940 9400
Fax: +44 118 940 9401
Email: service@aerotech.co.uk

Germany:
Phone: +49 911 967 9370
Fax: +49 911 967 93720
Email: service@aerotechgmbh.de

Japan:
Phone: +81(0)47-489-1741 (Sales)
Phone: +81(0)47-489-1742 (Service)
Fax: +81(0)47-489-1743
Email: service@aerotechkk.com.jp

China:
Phone: +852-3793-3488
Email: saleschina@aerotech.com

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Chapter 1: Overview

Figure 1-1 shows a typical PRO225 positioning stage. The PRO225 series of ballscrew positioning stages have travel distances ranging from 100 to 1500 mm.

This chapter introduces standard and optional features of the PRO225 stages, explains the model numbering system, and gives general safety precautions.

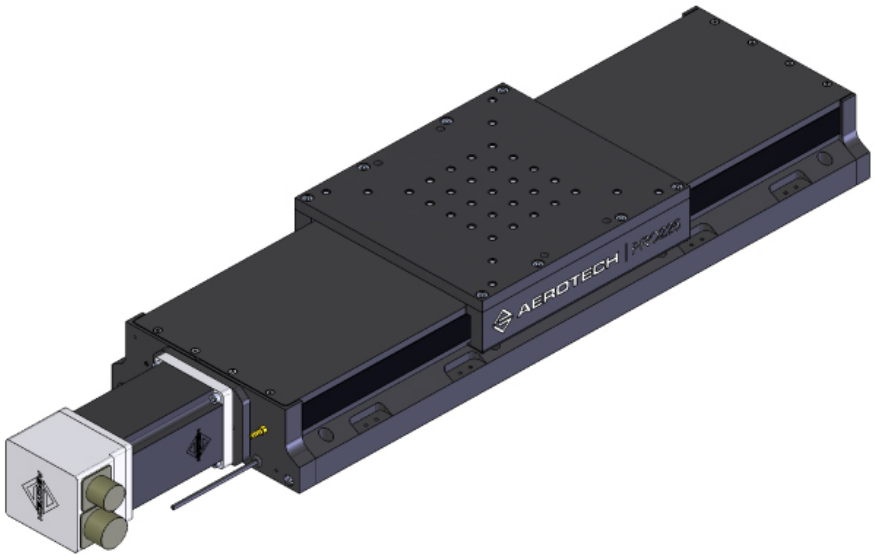


Figure 1-1: Typical PRO225 Series Linear Positioning Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

1.1. Standard Features

A precision ground ballscrew and Linear Motion Guide (LMG) are standard features on all PRO225 stages. The precision-ground, preloaded ballscrew ensures superior positioning resolution and accuracy while the LMG bearing system provides stiffness, good load carrying capabilities, and continuous load support over the entire range of travel. Other standard design features include an integral hardcover, side seals, and an air purge to keep contamination out of the interior of the stage, and integral wipers on the ballscrew nut and bearing trucks to further reduce contamination. Optical limit switches and mechanical end stops, which protect the carriage from over-travel, are also standard.

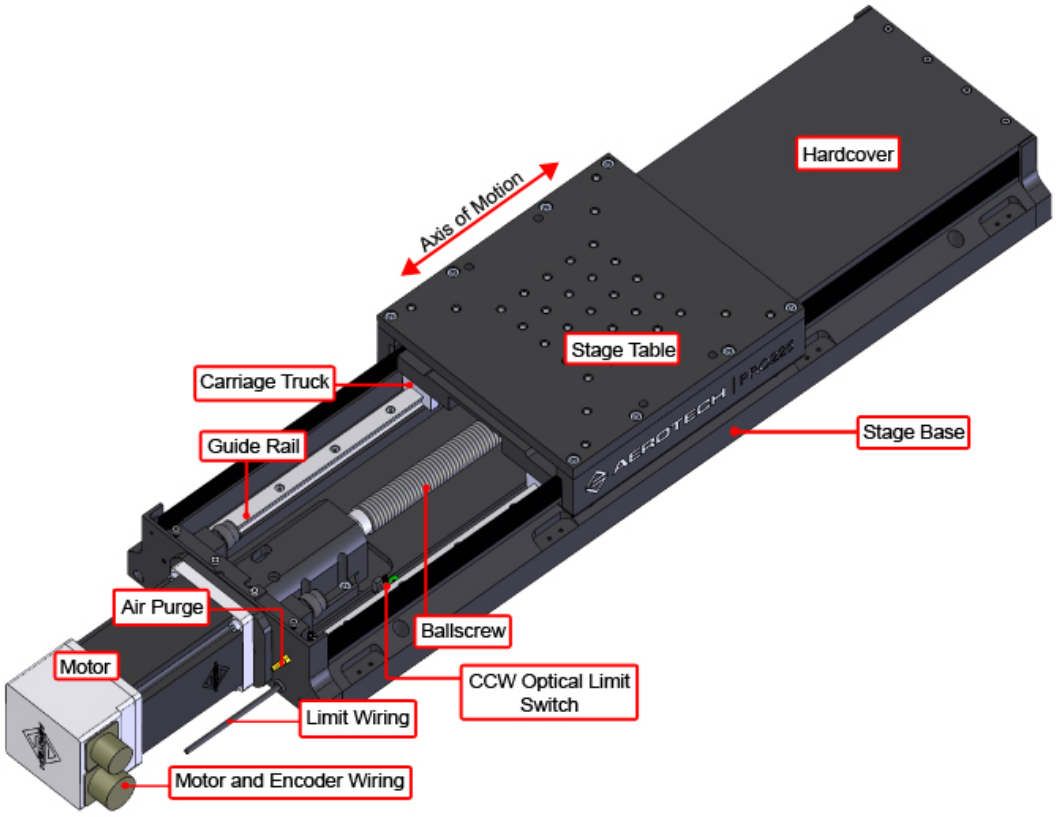


Figure 1-2: PRO225 with Cutaway View of Ballscrew

1.1.1. Optional Features

Available assembly options allow the PRO225 series stages to be configured for a variety of applications.

The standard motors for the PRO225 are the BM250 and BMS280, which includes a 2500 line incremental squarewave encoder and is available with an optional brake. A foldback option is available for use in space-constrained applications. In addition, any motor with a NEMA 34 frame size and 12.7 mm (1/2") shaft can be mounted to the stage or to the foldback.

The stage table is available with the mounting holes and grid pattern in either English (-TTU) or Metric (-TTM) dimensions. The –TTADR tabletop option provides quick mounting of an Aerotech ADRS-150, ADRS-200, ADRT-150, or ADRT-200 rotary stage. The -TTAGR tabletop option provides quick mounting of an Aerotech AGR-100 or AGR-150 rotary stage. Optional wipers can be installed on all tabletops (or to the stage base for XY applications) to prevent accumulation of debris on the hard cover. PRO225 stages can easily be assembled in XY axis arrangements. With two PRO225 stages in an XY stack, the upper axis can be bolted directly to the lower axis' carriage, thereby reducing system height. Use of the –TTM tabletop option on a lower axis of an XY stack allows the upper axis to be a PRO165 or a PRO115 stage for height and/or moving mass savings.

Dedicated angle brackets are available to allow the stages to be mated to form XZ or XYZ axis arrangements. Multi-axis combinations can be optionally aligned to either 10 or 5-arc sec orthogonality. See Figure 1-3 for examples of multi-axis arrangements. Optional lifting features can be added for stages over 300 mm in length. They are typically used on multi-axis systems. See Section 4.4. for instructions on how to install/remove lifting lugs.

For vacuum applications, two vacuum preparation options are available upon request; one compatible with low vacuum environments (down to 10^{-3} torr) and the other for high vacuum (10^{-3} to 10^{-6} torr) applications.

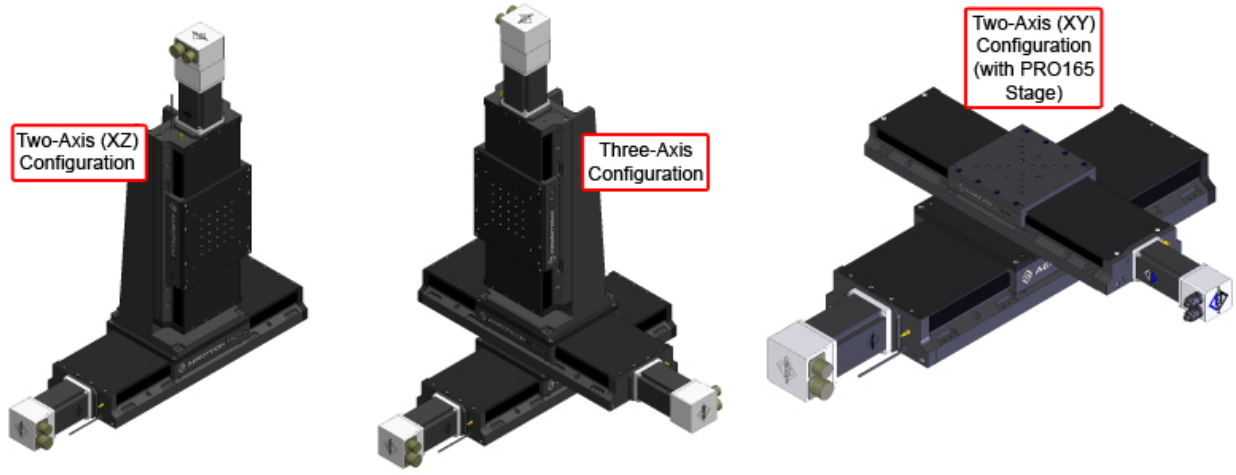


Figure 1-3: XZ, XY, and XYZ Axis Positioning Systems using PRO225 stages

1.1.2. Toe Clamp Accessory

PRO225 Series Stages can be ordered with toe clamps to mount the stages to English pattern breadboards. Figure 1-4 illustrates the use of these toe clamps. The recommended number of toe clamps per stage is given in Table 1-1.

Table 1-1: Number of Recommended Toe Clamps for English Mounting of PRO225 Series Stages

Stage Configuration (5 mm)	Quantity	Stage Configuration (25 mm)	Quantity
PRO225-05MM-0100	4	PRO225-25MM-0100	4
PRO225-05MM-0150	4	PRO225-25MM-0150	8
PRO225-05MM-0200	4	PRO225-25MM-0200	8
PRO225-05MM-0250	8	PRO225-25MM-0250	8
PRO225-05MM-0300	8	PRO225-25MM-0300	8
PRO225-05MM-0400	8	PRO225-25MM-0400	8
PRO225-05MM-0500	8	PRO225-25MM-0500	8
PRO225-05MM-0600	8	PRO225-25MM-0600	8
PRO225-05MM-0800	8	PRO225-25MM-0800	12
PRO225-05MM-1000	12	PRO225-25MM-1000	12
		PRO225-25MM-1200	12
		PRO225-25MM-1500	12

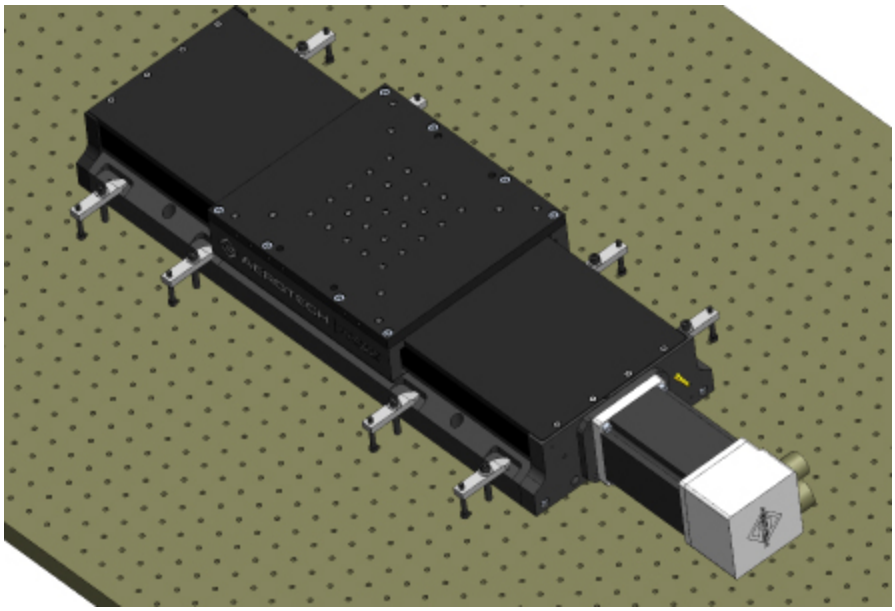


Figure 1-4: PRO225 Series Stage Mounted to Breadboard with Toe Clamps

1.1.3. Model Numbers

Stage model number example: PRO225-05MM-0100-TTM-5V-NC-BM-3-C05-PLOTS

Table 1-2 lists the available options in the order they appear in the example above. Aerotech continually improves its product offerings, and listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

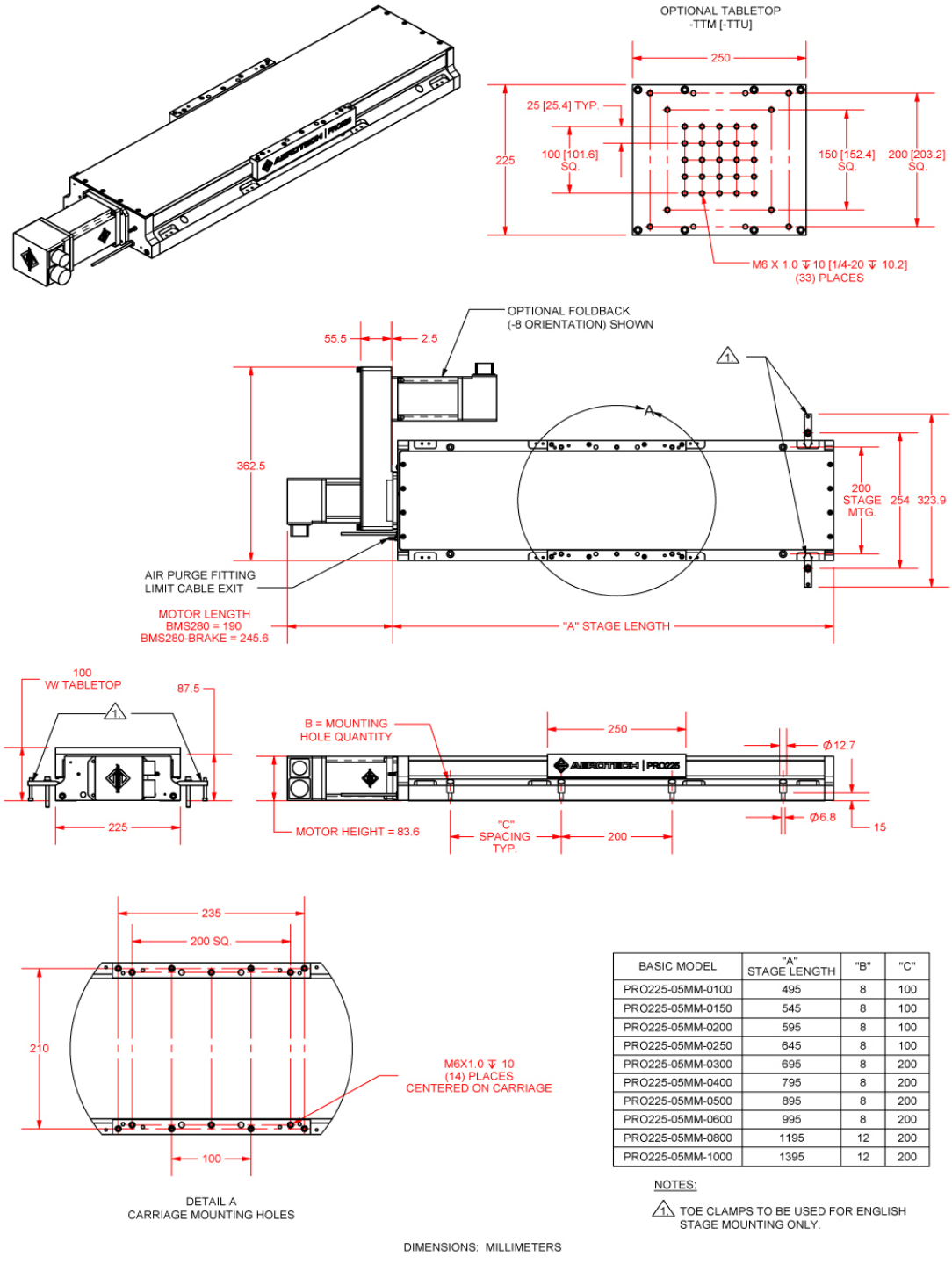
Table 1-2: Model Numbering System

Ball Screw	
-05MM	5 mm per revolution ball screw
-HS-25MM	25 mm per revolution ball screw
Travel Options (25 mm lead ballscrew)	
-0100	100 mm (4 in) travel stage with ballscrew and limits
-0150	150 mm (6 in) travel stage with ballscrew and limits
-0200	200 mm (8 in) travel stage with ballscrew and limits
-0250	250 mm (10 in) travel stage with ballscrew and limits
-0300	300 mm (12 in) travel stage with ballscrew and limits
-0400	400 mm (16 in) travel stage with ballscrew and limits
-0500	500 mm (20 in) travel stage with ballscrew and limits
-0600	600 mm (24 in) travel stage with ballscrew and limits
-0800	800 mm (32 in) travel stage with ballscrew and limits
-1000	1000 mm (40 in) travel stage with ballscrew and limits
-1200	1200 mm (48 in) travel stage with ballscrew and limits
-1500	1500 mm (60 in) travel stage with ballscrew and limits
Tabletop Options	
-NOTT	No tabletop
-TTM	Metric hole-pattern tabletop
-TTU	English hole-pattern tabletop
-TTM-WIPER	Metric hole-pattern tabletop with wipers
-TTU-WIPER	English hole-pattern tabletop with wipers
-TTADR	Bolt-hole pattern to attach ADRS-200 and ADRT-200 rotary stages
-TTADR-WIPER	Bolt-hole pattern to attach ADRS-200 and ADRT-200 rotary stages with wipers
-TTAGR	Bolt-hole pattern to attach AGR series rotary stages
-TTAGR-WIPER	Bolt-hole pattern to attach AGR series rotary stages with wipers
Limit Options	
-5V-NC	5V normally-closed end of travel and home limit switches (standard)
-5V-NO	5V normally-open end of travel and home limit switches
-24V-NC	24V normally-closed end of travel and home limit switches
Motor Options	
-NM	No motor
-BM	Brushless servomotor with 2500 line encoder (BM250-MS-E2500H)
-BM-BRK	Brushless servomotor with 2500 line encoder and brake (BM250-MS-E2500H-BK1)
-BMS	Brushless, slotless servomotor with 2500 line encoder (BM280-AH-MS-E2500H)
-BMS-BRK	Brushless, slotless servomotor with 2500 line encoder and brake (BM280-AH-MS-E2500H-BK1)

Table 1-2: Model Numbering System (continued)

Motor Options (continued)	
-BM-AS	Brushless servomotor with 1000 line amplified sine encoder (BM250-MS-E1000ASH)
-BM-AS-BRK	Brushless servomotor with 1000 line amplified sine encoder and brake (BM250-MS-E1000ASH-BK1)
-BMS-AS	Brushless, slotess servomotor with 1000 line amplified sine encoder (BM280-AH-MS-E1000ASH)
-BMS-AS-BRK	Brushless, slotess servomotor with 1000 line amplified sine encoder and brake(BM280-AH-MS-E1000ASH-BK1)
Motor Orientation	
-0	No motor
-2	Bottom cable exit
-3	Left cable exit
-4	Top cable exit
-5	Right cable exit
-8	Right side foldback
-12	Left side foldback
Options	
-FB05	Motor fold back kit for 0.500 inch diameter motor shaft
-BASE WIPER	Wiper on base of top axis of XY pair to clear hardcover of bottom axis
-LIFTING	Threaded inserts and lifting lugs; recommended for longer travel stages and XY assemblies
Coupling Option	
-C05	0.500 inch diameter motor shaft coupling
-NONE	No Coupling
Testing	
-PLOTS	Accuracy, straightness, flatness plots
-NO PLOTS	No accuracy, straightness, or flatness plots
Accessories (to be ordered as separate line item)	
ALIGNMENT-NPA	Non-precision XY assembly
ALIGNMENT-NPAZ	Non-precision XZ or XY assembly
ALIGNMENT-PA10	XY assembly; 10 arc sec orthogonal
ALIGNMENT-PA10Z	XZ or YZ assembly with L-bracket; 10 arc second orthogonal
ALIGNMENT-PA5	XY assembly; 5 arc sec orthogonal
ALIGNMENT-PA5Z	XZ or YZ assembly with L-bracket; 5 arc second orthogonal
HDZ225	Right angle L-bracket for PRO225-100 and -150
TC-PRO225	Toe clamp for mounting the stage to English pattern breadboards

1.2. Dimensions

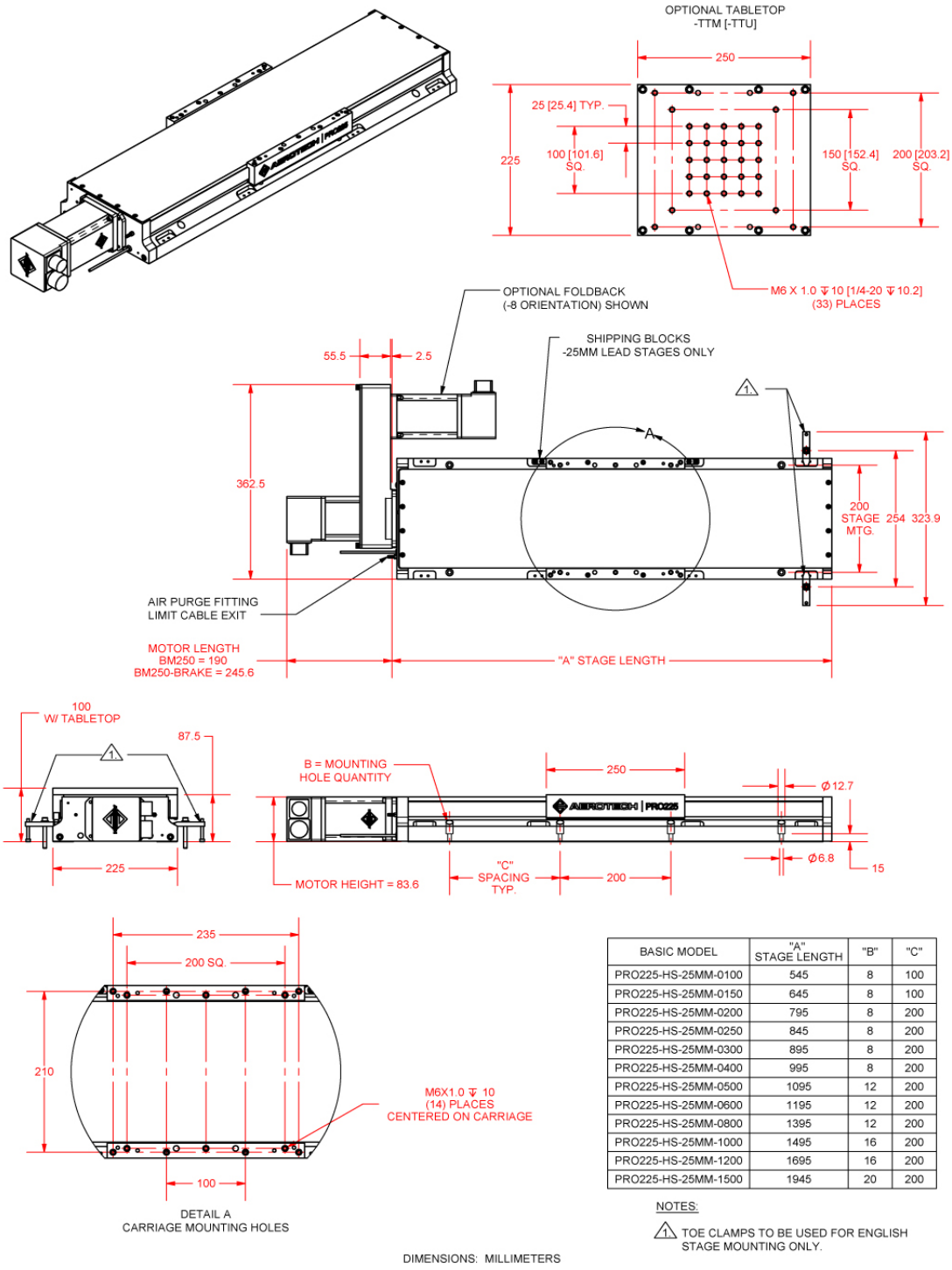


BASIC MODEL	"A" STAGE LENGTH	"B"	"C"
PRO225-05MM-0100	495	8	100
PRO225-05MM-0150	545	8	100
PRO225-05MM-0200	595	8	100
PRO225-05MM-0250	645	8	100
PRO225-05MM-0300	695	8	200
PRO225-05MM-0400	795	8	200
PRO225-05MM-0500	895	8	200
PRO225-05MM-0600	995	8	200
PRO225-05MM-0800	1195	12	200
PRO225-05MM-1000	1395	12	200

NOTES:

1. TOE CLAMPS TO BE USED FOR ENGLISH STAGE MOUNTING ONLY.

Figure 1-5: PRO225 Dimensions



BASIC MODEL	"A" STAGE LENGTH	"B"	"C"
PRO225-HS-25MM-0100	545	8	100
PRO225-HS-25MM-0150	645	8	100
PRO225-HS-25MM-0200	795	8	200
PRO225-HS-25MM-0250	845	8	200
PRO225-HS-25MM-0300	895	8	200
PRO225-HS-25MM-0400	995	8	200
PRO225-HS-25MM-0500	1095	12	200
PRO225-HS-25MM-0600	1195	12	200
PRO225-HS-25MM-0800	1395	12	200
PRO225-HS-25MM-1000	1495	16	200
PRO225-HS-25MM-1200	1695	16	200
PRO225-HS-25MM-1500	1945	20	200

NOTES:

1. TOE CLAMPS TO BE USED FOR ENGLISH STAGE MOUNTING ONLY.

Figure 1-6: PRO225-HS Dimensions

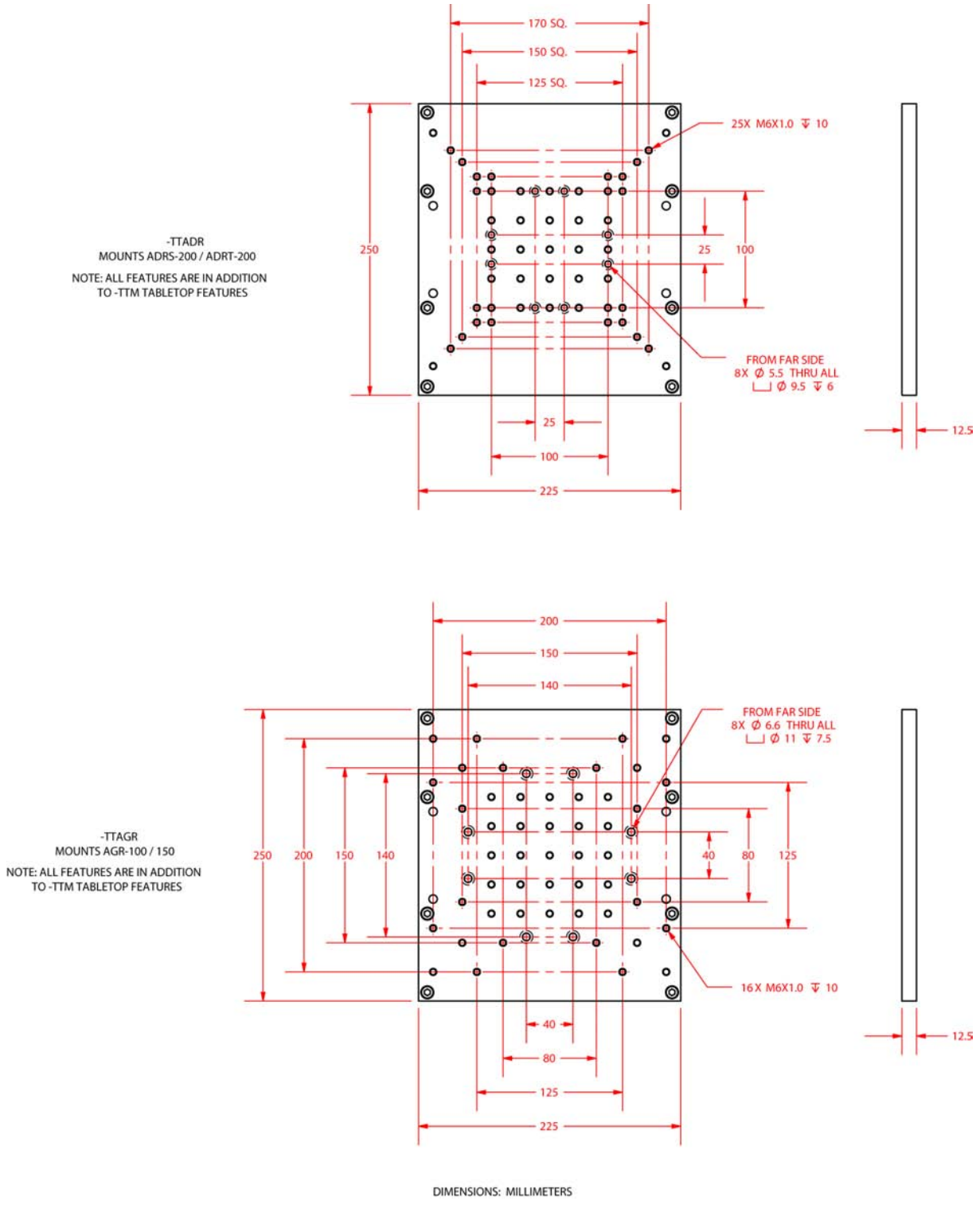


Figure 1-7: PRO225 Tabletop Dimensions

1.3. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and damage to the equipment.

This manual and any additional instructions included with the stage should be retained for the lifetime of the stage.

	To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.
	To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the stage is connected to a power source.
	To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.
	Moving parts of the stage can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.
	Improper use of the stage can cause damage, shock, injury, or death. Read and understand this manual before operating the stage.
	If the stage is used in a manner not specified by the manufacturer, the protection provided by the stage can be impaired.
	Stage cables can pose a tripping hazard. Securely mount and position all stage cables to avoid potential hazards.

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

Use care when moving the stage. Manually lifting or transporting stages can result in injury.

Only trained personnel should operate, inspect, and maintain the stage.

This stage is intended for light industrial manufacturing or laboratory use. Use of the stage for unintended applications can result in injury and damage to the equipment.

Before using this stage, perform an operator risk assessment to determine the needed safety requirements.

1.4. EC Declaration of Incorporation

Manufactorer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:
Aerotech, Inc. PRO225 Stage
is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:
EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
Safety of machinery - Electrical equipment of machines - Part 1: General requirements
and further more declares that
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: March 29, 2011

Chapter 2: Installation

This chapter describes the installation procedure for the PRO225 stage, including handling the stage properly, preparing the mounting surface to accept the stage, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.

Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. If the stage has lifting features, see Section 4.4. for installation/removal. **The lifting features must be removed before stage can operate.** Set the stage on a smooth, flat, and clean surface. This is a simple, yet very important step in maintaining the integrity of the stage.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.

Improper stage handling could adversely affect the stage's performance. Therefore, use care when moving the stage. Manually lifting or transporting stages can result in injury.

Lift the stage only by the base.

Do not use the ballscrew or motor as lifting points

2.2. Preparing the Mounting Surface

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the PRO225. When an PRO225 series stage is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened (see Figure 2-1

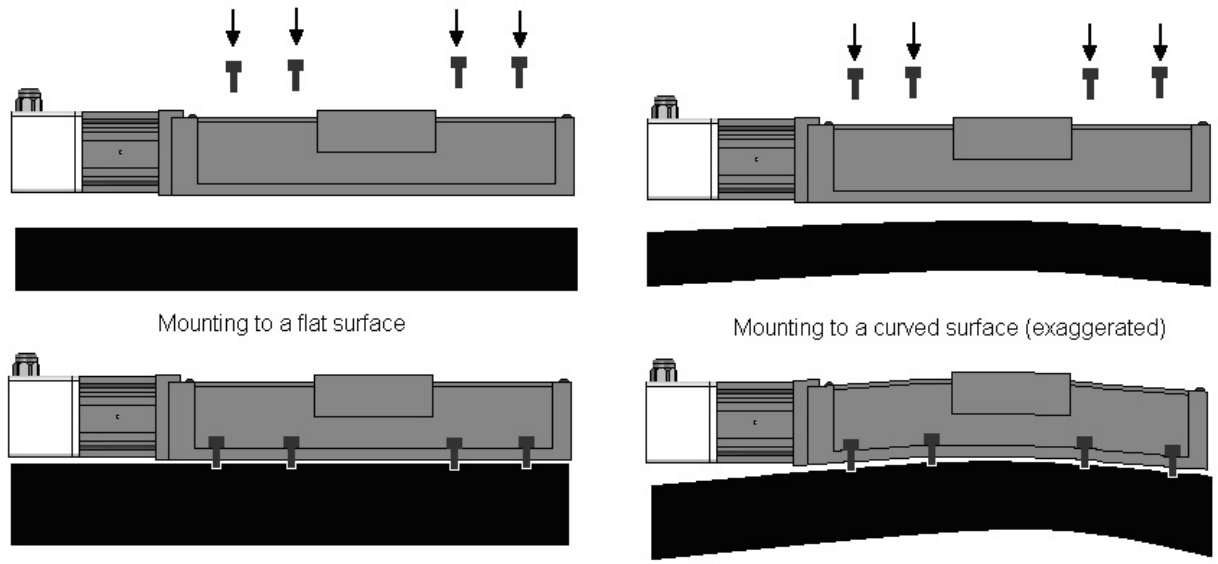


Figure 2-1: Mounting to a Flat Surface

NOTE: To maintain accuracy, the mounting surface should be flat, as specified in Table 2-1.

Any distortion will decrease the overall accuracy of the stage. Aerotech recommends stoning the mounting surface and the stage base with precision flat stones prior to mounting the stage to the mounting surface to remove any local high spots or imperfections in the surfaces.Adjustments to the mounting surface must be done before the stage is secured.

NOTE: The stage base is precision machined and verified for flatness prior to stage assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the stage base. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

Table 2-1: Stage Mounting Surface Flatness Requirement

Stage Travel	Flatness Requirement
100-300 mm	5 µm
400-600 mm	7.5 µm
800-1000 mm	10 µm
1000-1500 mm	12.5 µm

2.3. Shipping Brackets

The 25 mm lead PRO225 stages come equipped with shipping brackets as shown in Figure 2-2. Remove the shipping brackets once the stage has been placed on the mounting surface. Each bracket is mounted in place with two M4-0.7 socket head cap screws. Retain the brackets for future use.

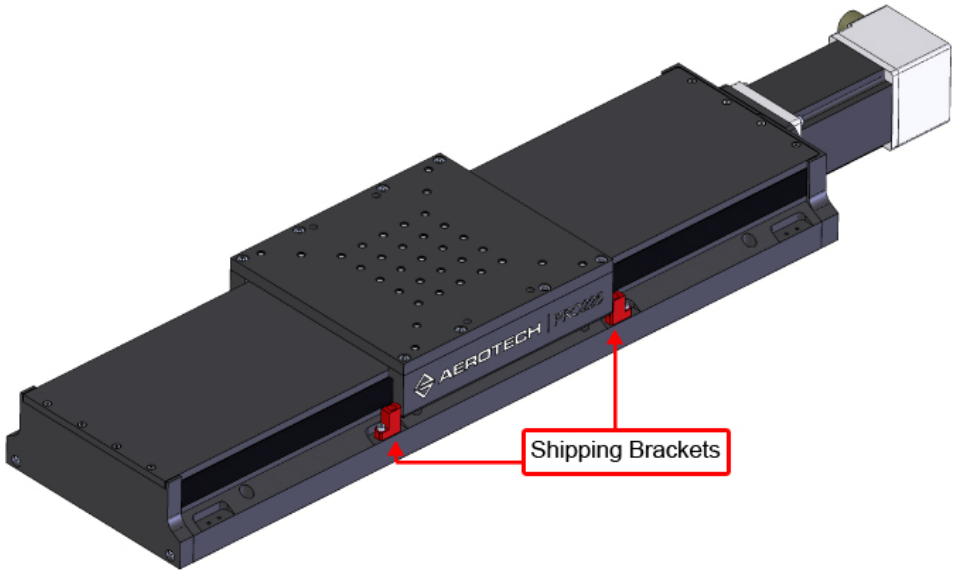


Figure 2-2: Shipping Bracket Locations

2.4. Securing the Stage to the Mounting Surface

If necessary, manually move the stage table to access the 6.5 mm (0.28 in) diameter mounting holes along the edges of the stage (refer to Figure 2-3). This stage is designed to use socket head cap screws (SHCS) to secure the base to the mounting surface. Use M6 x 25 mm or ¼-20 x 1" long SHCS with flat washers to 1.5x diameter thread engagement. Torque the mounting screws to 8.1 N*m (6 ft*lb).

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

NOTE: The stage table may offer a considerable amount of resistance when it is moved manually. This is especially true if the stage is fitted with a motor assembly.

NOTE: If the stage is not connected to a power source, and not equipped with an optional brake, it should be possible to move the stage table by hand with steady even pressure. Do not attempt to manually move the stage if it is connected to a power source or includes an integrated brake.

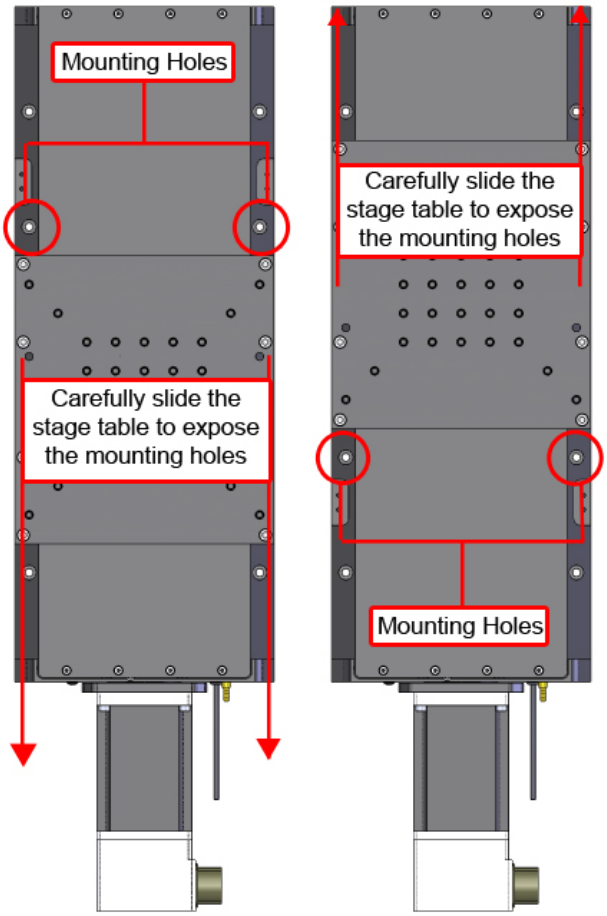

Mounting Holes
Carefully slide the stage table to expose the mounting holes
Carefully slide the stage table to expose the mounting holes
Mounting Holes

Figure 2-3: Mounting Hole Locations

2.5. Attaching the Payload to the Stage

To prevent damage to the stage or parts, test the operation of the stage before any payload is mounted to the stage tabletop. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical connections, refer to the Electrical Installation section later in this chapter, the documentation of the motion control system delivered with the stage, and the wiring drawings in Chapter 3: Operating Specifications.

The payload must be flat, rigid and comparable to the stage in quality.

NOTE: For valid accuracies, the mounting interface should be flat within 1 µm per 50 mm.

Refer to Section 3.4. for information on cantilevered loads and load positioning.

NOTE: Do not attach a payload to the stage table with screws that are too long. A screw passing through the stage table can come into contact with the hardcover, affecting travel and possibly damaging the stage.

2.6. Electrical Installation

Electrical installation requirements will vary depending on stage options. Installation instructions in this section are for stages equipped with standard Aerotech motors intended for use with an Aerotech motion control system. Contact Aerotech for further information regarding stages that are otherwise configured.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the PRO225 series stage is part of a complete Aerotech motion control system, setup involves connecting a stage and motor combination to the appropriate drive chassis with the cables provided. Connect the provided cables to the appropriate locations shown in Figure 2-4. Labels on the drive indicate the appropriate connections. Refer to you drive manuals and documentation for additional installation and operation information. In some cases, if the system is uniquely configured, a drawing showing system interconnects is supplied.

See Section 3.6. for more information on the electrical connections on the PRO225, including pinouts.

Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage may result.

The stage's protective ground is located on pin D of the motor power connector. If you are using cables other than those provided by Aerotech, you must connect pin D to a ground connection.

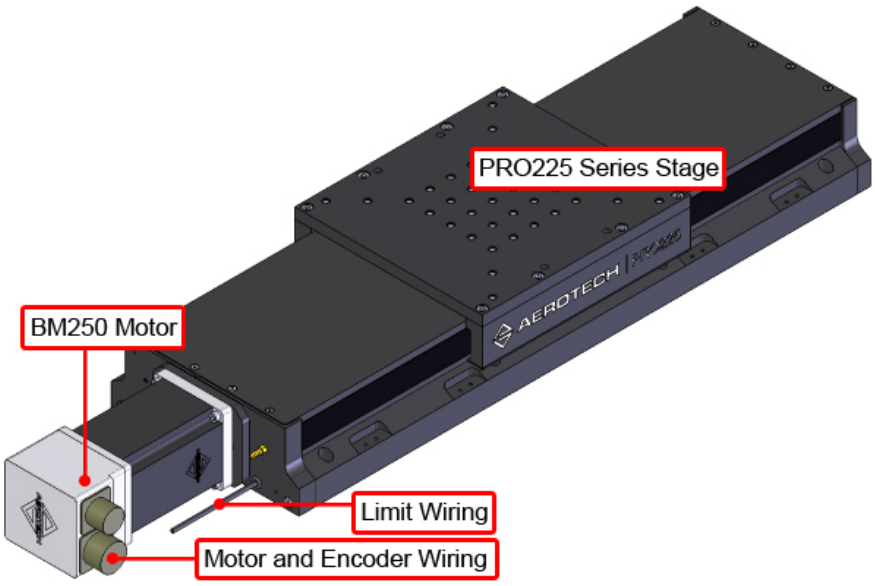


Figure 2-4: Electrical Components of a Typical PRO225 Stage

2.6.1. Standard Aerotech Motor Options

The BM250, one of Aerotech's high performance brushless rotary motors, is the standard motor for 5 mm lead-PRO225 stages. The BMS280 is the standard motor for -HS-25 mm stages. The PRO225 is equipped with optical limit switches, which can be configured normally closed (NC) or normally open (NO). The limit cable exits the stage on the same side as the motor and is bundled with the motor cables. The customer has the option of flying leads or a 9-pin D connector for the end of the limit cable. The electrical wiring from the motor and encoder to the "connectorized" ports on the motor can is contained within the rear motor housing and has been completed at the factory. The motor cables and limit cable convey motor power, encoder feedback, and limit switch signals to an appropriate hardware device (e.g. axis controller or amplifier). Refer to Section 3.6. for standard motor wiring and connector pin outputs.

2.6.2. Motor Foldback Options

When the foldback option is chosen, any motor with a standard NEMA 34 frame size and 1/2" motor shaft may be used. The belt pulleys are attached to the motor shaft with two set screws. See Figure 4-5 and Figure 4-6 for illustrations showing the locations of the set screws as well as the entire pulley and belt power transfer system. Refer to Section 4.3. for more information about the foldback option.

2.6.3. Optical Limit Switches

PRO225 stages are equipped with a pair of optical limit switches. The limit switch wiring passes through the front end plate and into a 9-pin D connector where it is then attached to the motor wiring. Refer to Section 3.5. for a description of limit switch operation and wiring.

Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the stage. This chapter provides information on ideal environmental and operating conditions. Also included are instructions for estimating load capability and torque required to turn the ballscrew given various loadings.

3.1. Environmental Specifications

The environmental specifications for the PRO225 are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C ±2° C (68° F ±4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect stage and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The PRO225 stages have limited protection against dust, but not water. This equates to an ingress protection rating of IP50.
Use	Indoor use only

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Accuracy and Temperature Effects

The accuracy specification of PRO225 series stages is measured at the center of travel 25 mm above the table with the stage in a horizontal position. The stage is assumed to be fully supported by a mounting surface meeting or exceeding the specification in Table 2-1.

The accuracy of the ballscrew is a key element in the overall positioning accuracy. A scale error can be expected if temperature of the ballscrew differs from 20° C (68° F). The greater the temperature difference, the greater the error. The temperature of the ballscrew depends on the speed and duty cycle of the stage. The faster the movement and higher the duty cycle, the more the stage accuracy will be affected by heat. The thermal expansion coefficient of the ballscrew is 11.7×10^{-6} ppm/°C.

3.3. Basic Specifications

Specifications for PRO225 series positioning stages with a 5mm/rev lead are shown in Table 3-2. Specifications for PRO225 series positioning stages with a 25mm/rev lead are shown in Table 3-3. Resolution is dependent on ballscrew pitch, encoder resolution, and controller interpolation. Table 3-4 shows standard motor specifications for the PRO225.

Table 3-2: PRO225 Series Specifications -5 mm/rev lead

Basic Model		PRO225-0100	PRO225-0150	PRO225-0200	PRO225-0250	PRO225-0300
Total Travel		100 mm	150 mm	200 mm	250 mm	300 mm
Drive System		Precision Ball Screw/Brushless Servomotor (BM250-MS-E2500H)				
Bus Voltage		Up to 320 VDC				
Continuous Current	APK	Up to 10 A				
	ARMS	Up to 7.1 A				
Feedback		Noncontact Rotary Encoder (2500 line)				
Resolution	5 mm/rev lead	0.5 µm with 2500 line Quadrature Encoder				
Maximum Travel Speed(1)	5 mm/rev lead	220 mm/s	220 mm/s	220 mm/s	220 mm/s	220 mm/s
Maximum Load (2)	Horizontal	100 kg				
	Vertical	60 kg				
	Side	100 kg				
Accuracy	5 mm/rev lead	±11 µm	±13 µm	±16 µm	±16.5 µm	±17.5 µm
Bidirectional Repeatability	5 mm/rev lead	±1 µm				
Straightness and Flatness		4 µm	5 µm	5 µm	6 µm	7 µm
Nominal Stage Weight	With Motor	23.0 kg (50.6 lb)	24.2 kg (53.2 lb)	25.4 kg (55.9 lb)	26.6 kg (58.5 lb)	27.7 kg (60.9 lb)
	Less Motor	19.4 kg (42.7 lb)	20.6 kg (45.3 lb)	21.8 kg (48.0 lb)	23.0 kg (50.6 lb)	24.1 kg (53.0 lb)
Construction		Black Anodized Aluminum Body with Hardcoated Tabletop				

1. Excessive duty cycle may impact stage accuracy.
2. Payload specifications are for single-axis system and based on ball screw and bearing life of 2500 km (100 million inches) of travel.
3. Specifications are for single-axis systems, measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-2: PRO225 Series Specifications -5mm/rev lead (continued)

Basic Model		PRO225-0400	PRO225-0500	PRO225-0600	PRO225-0800	PRO225-1000
Total Travel		400 mm	500 mm	600 mm	800 mm	1000 mm
Drive System		Precision Ball Screw/Brushless Servomotor (BM250-MS-E2500H)				
Bus Voltage		Up to 320 VDC				
Continuous Current	APK	Up to 10 A				
	ARMS	Up to 7.1 A				
Feedback		Noncontact Rotary Encoder (2500 line)				
Resolution	5 mm/rev lead	0.5 µm with 2500 line Quadrature Encoder				
Maximum Travel Speed(1)	5 mm/rev lead	220 mm/s	220 mm/s	220 mm/s	220 mm/s	140 mm/s
Maximum Load (2)	Horizontal	100 kg				
	Vertical	60 kg				
	Side	100 kg				
Accuracy	5 mm/rev lead	±19 µm	±21 µm	±23 µm	±26 µm	±27.5 µm
Bidirectional Repeatability	5 mm/rev lead	±1 µm				
Straightness and Flatness		9 µm	11 µm	13 µm	16 µm	19 µm
Nominal Stage Weight	With Motor	30.1 kg (66.2 lb)	32.4 kg (71.3 lb)	34.81 kg (76.6 lb)	39.5 kg (86.9 lb)	44.1 kg (97.0 lb)
	Less Motor	26.5 kg (58.3 lb)	28.8 kg (63.4 lb)	31.2 kg (68.6 lb)	35.9 kg (79.0 lb)	40.5 kg (89.1 lb)
Construction		Black Anodized Aluminum Body with Hardcoated Tabletop				

1. Excessive duty cycle may impact stage accuracy.
2. Payload specifications are for single-axis system and based on ball screw and bearing life of 2500 km (100 million inches) of travel.
3. Specifications are for single-axis systems, measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-3: PRO225 Series Specifications -25 mm/rev lead

Basic Model		PRO225-0100	PRO225-0150	PRO225-0200	PRO225-0250
Total Travel		100 mm	150 mm	200 mm	250 mm
Drive System		Precision Ball Screw/Brushless Servomotor (BM250-MS-E2500H)			
Bus Voltage		Up to 320 VDC			
Continuous Current	APK	Up to 10 A			
	ARMS	Up to 7.1 A			
Feedback		Noncontact Rotary Encoder (2500 line)			
Resolution	25 mm/rev lead	2.5 µm with 2500 line Quadrature Encoder			
Maximum Travel Speed(1)	25 mm/rev lead	600 mm/s	750 mm/s	850 mm/s	950 mm/s
Maximum Load (2)	Horizontal	100 kg			
	Vertical	N/A			
	Side	100 kg			
Accuracy	25 mm/rev lead	±11 µm	±13 µm	±16 µm	±16.5 µm
Bidirectional Repeatability	25 mm/rev lead	±2.5 µm			
Straightness and Flatness		4 µm	5 µm	5 µm	6 µm
Nominal Stage Weight	With Motor	24.6 kg (54.1 lb)	26.8 kg (59.0 lb)	30.3 kg (66.7 lb)	31.5 kg (69.3 lb)
	Less Motor	21.0 kg (46.2 lb)	23.2 kg (51.0 lb)	26.7 kg (58.7 lb)	27.9 kg (61.4 lb)
Construction		Black Anodized Aluminum Body with Hardcoated Tabletop			

1. Excessive duty cycle may impact stage accuracy.
2. Payload specifications are for single-axis system and based on ball screw and bearing life of 2500 km (100 million inches) of travel.
3. Specifications are for single-axis systems, measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-3: PRO225 Series Specifications -25mm/rev lead (continued)

Basic Model		PRO225-0300	PRO225-0400	PRO225-0500	PRO225-0600
Total Travel		300 mm	400 mm	500 mm	600 mm
Drive System		Precision Ball Screw/Brushless Servomotor (BM250-MS-E2500H)			
Bus Voltage		Up to 320 VDC			
Continuous Current	APK	Up to 10 A			
	ARMS	Up to 7.1 A			
Feedback		Noncontact Rotary Encoder (2500 line)			
Resolution	25 mm/rev lead	2.5 µm with 2500 line Quadrature Encoder			
Maximum Travel Speed(1)	25 mm/rev lead	1050 mm/s	1250 mm/s	1400 mm/s	1100 mm/s
Maximum Load (2)	Horizontal	100 kg			
	Vertical	N/A			
	Side	100 kg			
Accuracy	25 mm/rev lead	±17.5 µm	±19 µm	±21 µm	±23 µm
Bidirectional Repeatability	25 mm/rev lead	±2.5 µm			
Straightness and Flatness		7 µm	9 µm	11 µm	13 µm
Nominal Stage Weight	With Motor	32.6 kg (71.7 lb)	35.5 kg (77.0 lb)	37.3 kg (82.1 lb)	39.7 kg (87.3 lb)
	Less Motor	29.0 kg (63.8 lb)	31.4 kg (69.1 lb)	33.7 kg (74.1 lb)	36.1 kg (79.4 lb)
Construction		Black Anodized Aluminum Body with Hardcoated Tabletop			

1. Excessive duty cycle may impact stage accuracy.
2. Payload specifications are for single-axis system and based on ball screw and bearing life of 2500 km (100 million inches) of travel.
3. Specifications are for single-axis systems, measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-3: PRO225 Series Specifications -25mm/rev lead (continued)

Basic Model		PRO225-0800	PRO225-1000	PRO225-1200	PRO225-1500
Total Travel		800 mm	1000 mm	1200 mm	1500 mm
Drive System		Precision Ball Screw/Brushless Servomotor (BM250-MS-E2500H)			
Bus Voltage		Up to 320 VDC			
Continuous Current	APK	Up to 10 A			
	ARMS	Up to 7.1 A			
Feedback		Noncontact Rotary Encoder (2500 line)			
Resolution	25 mm/rev lead	2.5 µm with 2500 line Quadrature Encoder			
Maximum Travel Speed(1)	25 mm/rev lead	700 mm/s	600 mm/s	450 mm/s	300 mm/s
Maximum Load (2)	Horizontal	100 kg			
	Vertical	N/A			
	Side	100 kg			
Accuracy	25 mm/rev lead	±26 µm	±27.5 µm	±31 µm	±35.5 µm
Bidirectional Repeatability	25 mm/rev lead	±2.5 µm			
Straightness and Flatness		16 µm	19 µm	22 µm	26 µm
Nominal Stage Weight	With Motor	44.3 kg (97.5 lb)	46.8 kg (103.0 lb)	51.6 kg (113.5 lb)	57.2 kg (125.8 lb)
	Less Motor	40.7 kg (89.5 lb)	43.2 kg (95.0 lb)	48.0 kg (105.6 lb)	53.6 kg (117.9 lb)
Construction		Black Anodized Aluminum Body with Hardcoated Tabletop			

1. Excessive duty cycle may impact stage accuracy.
2. Payload specifications are for single-axis system and based on ball screw and bearing life of 2500 km (100 million inches) of travel.
3. Specifications are for single-axis systems, measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

Table 3-4: PRO225 Series Standard Motor Specifications

Stage	Standard Motor	Current (A_{pk})		Maximum Drive Output Voltage (VDC)	Wire Gauge (Leads)
		Continuous	Peak		
PRO225 with 5 mm lead ballscrew	BMS280	3.8	15.2	340	24
PRO225 with 25 mm lead ballscrew	BM250	10.5	26.3	340	18

3.4. Load Capability

It is recommended that application loads be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). With the stage lying flat (horizontal) and the application load vertically applied and symmetrically distributed, the maximum vertical load carrying capacity of PRO225 stages is 100 kg. If cantilevered loads are applied, refer to Figure 3-1 to find the maximum allowable load.

In Figure 3-1, two curves are shown for different loading conditions. The Vertical curve is for situations where the stage is mounted in a vertical orientation and the payload is mounted to the table top with its center of gravity extended outward. The Horizontal curve assumes a horizontal stage orientation with the payload off-set extending upwards. The side curve is for situations where the stage is mounted on its side and the offset load extends outwards. See Figure 3-2 for clarification. If a cantilevered load situation is used, first determine if it is a vertical cantilever or side cantilever system based on Figure 3-2. Measure the cantilever length, then find the corresponding load value from Figure 3-1.

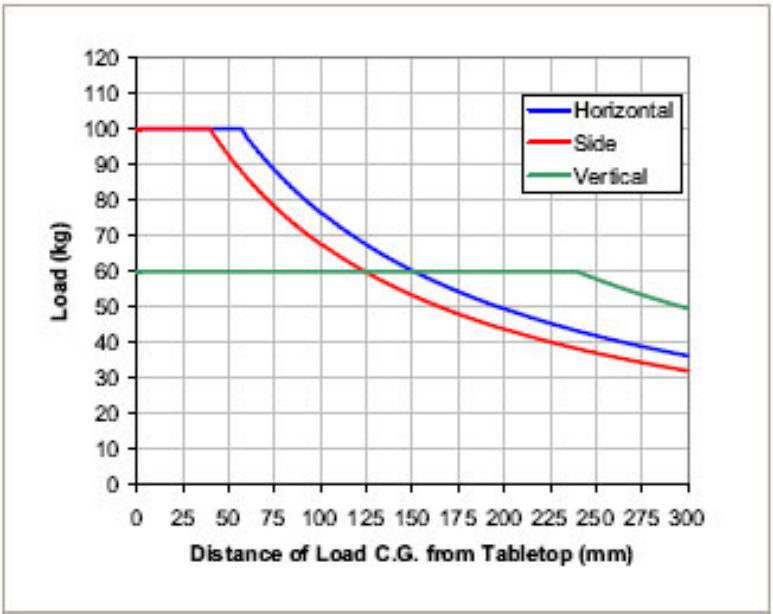


Figure 3-1: Load Capability of PRO225 Series Stages

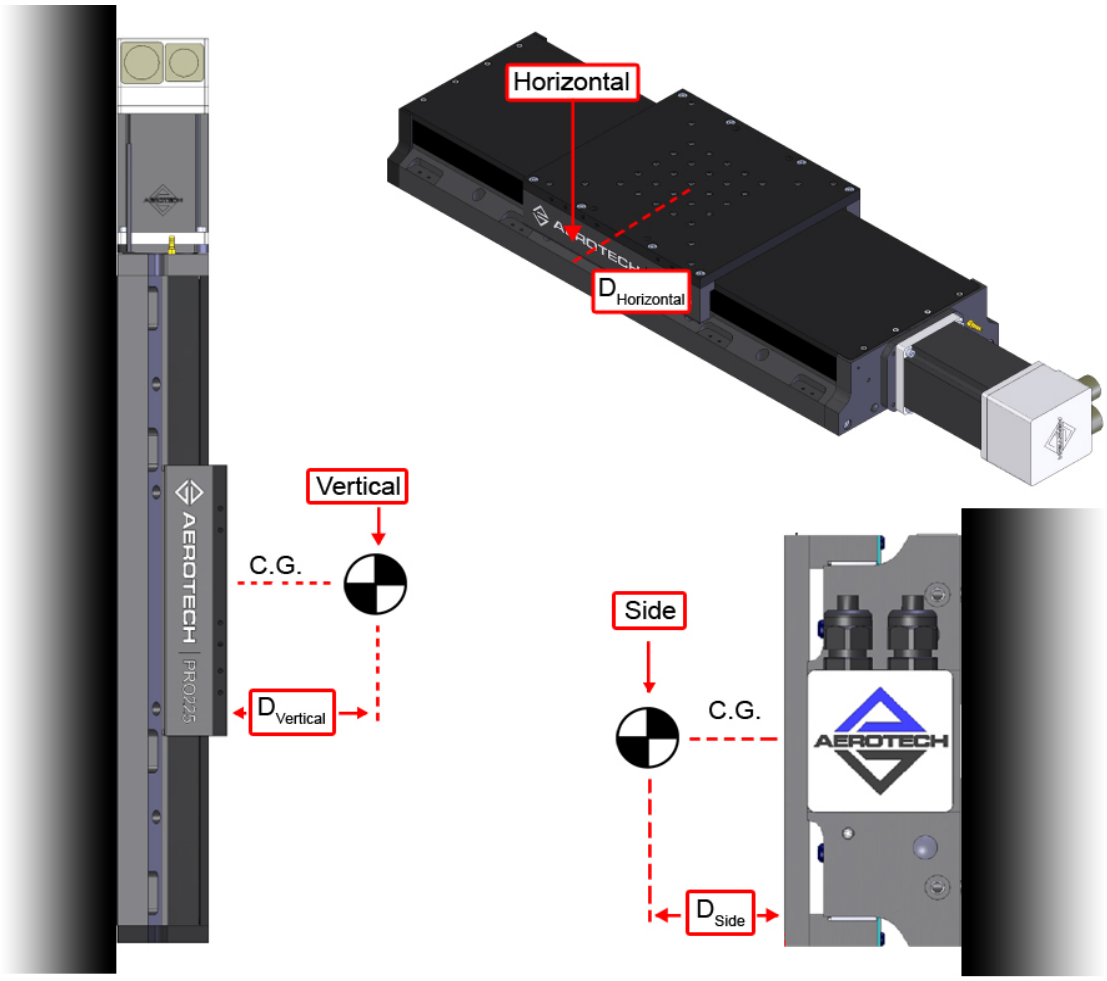


Figure 3-2: Stage Orientations

The approximate amount of torque required to turn the ballscrew of an PRO225 series stage can be found from Figure 3-3 or the following equation:

$$Torque_{REQ} = \frac{(AxialLoad)\ x\ (LeadofScrew)}{2\ x\ \pi\ x\ (Efficiency)}$$

For PRO225 series stages, the ballscrew efficiency is rated at 90% (0.90). Refer to Figure 3-3.

The maximum axial load carrying capacity of PRO225 stages is 60 kg (132 lb).

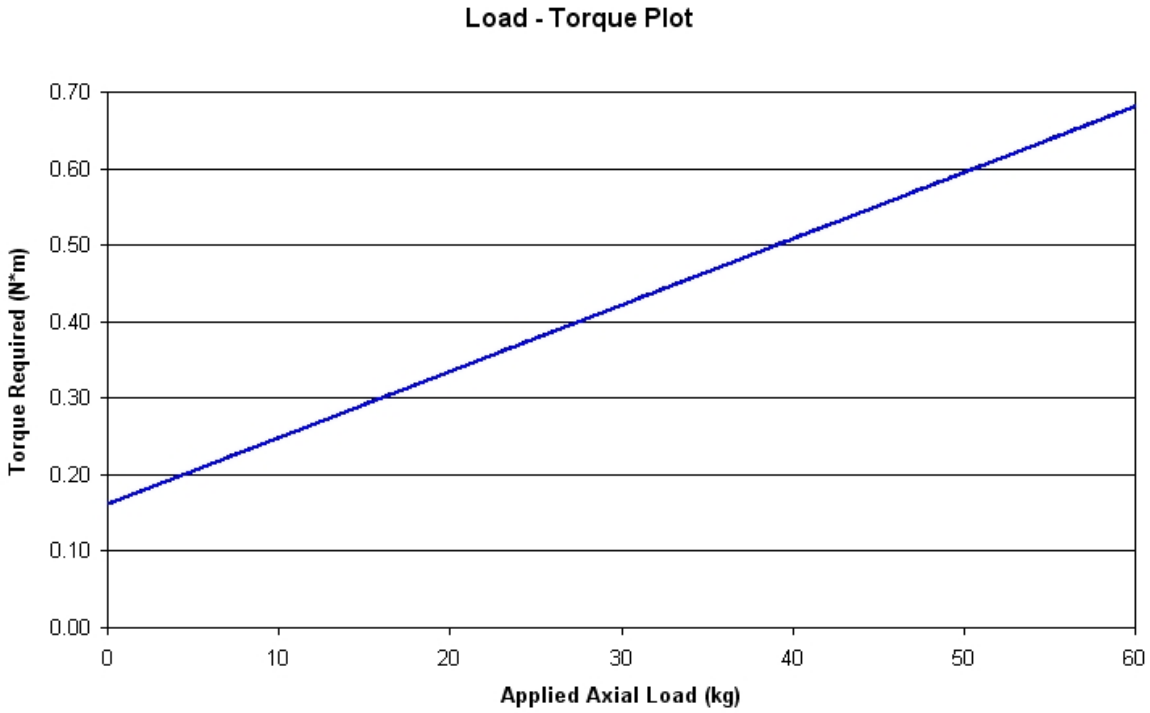


Figure 3-3: Torque Required to Turn Ballscrew with Various Loads in Vertical Orientation

3.5. Optical Limit Switch

PRO225 series stages are provided with a pair of optical limit switch assemblies mounted to the base of the stage. The limit switches signal when the stage has reached its maximum useable travel distance in both directions.

3.5.1. Limit Switch Operation

Each limit switch has a light source and detector mounted to a small printed circuit board. Each limit switch board is mounted at an end of the stage with its emitter–detector axes perpendicular to the direction of table motion. On a standard stage, the clockwise (CW) switch is located at the end opposite the motor. When movement of the stage table causes the blade mounted to the stage carriage to break the light beam from the emitter to the detector, a CW or counterclockwise (CCW) limit signal is generated. The limit switch itself can be configured as normally closed (NC) or normally open (NO).

If the stage is driven past the electrical limit, it will encounter the hard stop. Where the hard limit occurs is dependent on stage travel. In stages with a 5 mm lead ballscrew, the hard limit occurs ~2 revolutions (10 mm) for the 50 mm travel stage and ~1 revolution (5 mm) for the 600 mm travel stage. In stages with a 25 mm lead ballscrew the hard limit occurs ~2.8 revolutions (57 mm). Although the operating speed of the stage may be relatively slow, and the stage's shocks will provide some protection, damage to the stage could result.

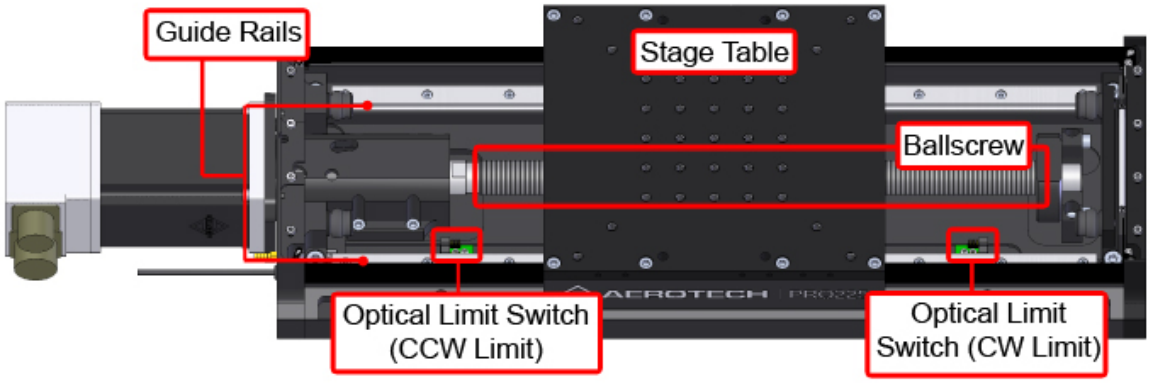


Figure 3-4: Internal View of a Typical Stage Showing Limit Switches

NOTE: Clockwise (CW) and counterclockwise (CCW) refer to the direction of motor rotation while looking into the shaft of the motor. For the PRO225, a CW rotation of the motor causes the stage table to move away from the motor. CCW rotation of the motor causes the stage table to move toward the motor. If an optional "foldback" option is used, the directions are reversed.

3.5.2. Limit Switch Wiring

Limit switches are open-collector, TTL–compatible, electro–optical devices that change output states when the stage approaches its maximum travel distance and breaks the light beam. Since they are open-collector devices, they may be interfaced to 24 Volt logic inputs. Each limit switch is mounted on a small printed circuit board. Standard PRO225 stages include wiring in a separate 9-pin limit switch connector, detailed in Figure 3-5.

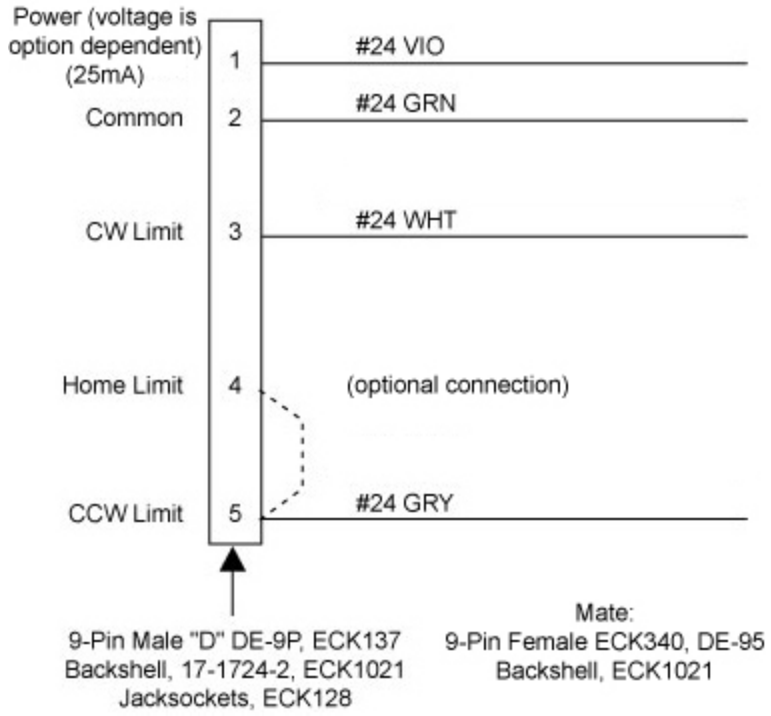


Figure 3-5: PRO225 Series 9-pin Limit Switch Wiring

In all PRO225 Series Stages with the -24V-NC limit option, pin 1 of the 9-pin Limit Switch will always be the power for the limits. You must connect either 5V DC or 24V DC based on the option you have purchased.

Assuming a -5V-NC limit configuration, the input to the controller is seen as a logic 0 (typical 0.4V @ 12.8 mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor, on the controller, causes a logic 1 (typically 4.8-5 V) to be seen by the controller input. The limit switch operation for a NO limit configuration is the exact opposite as described above. See Figure 3-6 for a diagram of limit switch wiring. The switch shown in Figure 3-6 is a PNP transistor (NPN for the -24V-NC option).

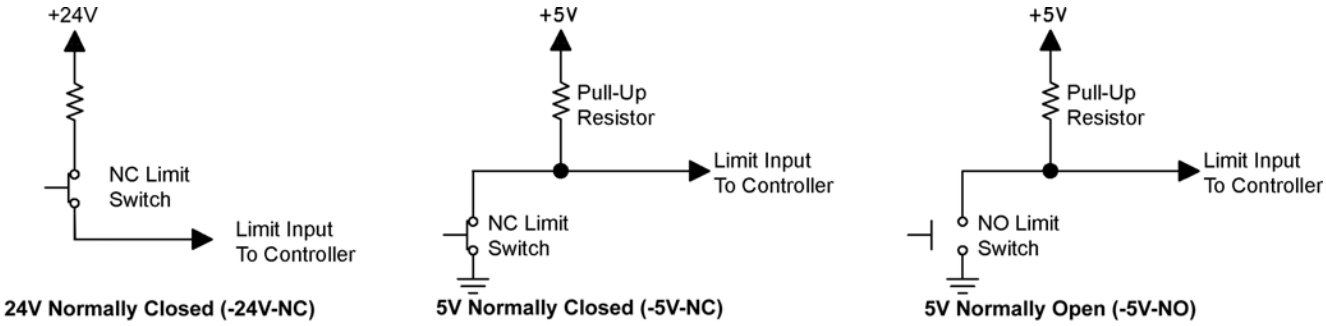


Figure 3-6: Limit Switch Wiring

3.6. Standard Motor Wiring

Stages fitted with standard motors and encoders come from the factory completely wired and assembled. For reference, connector pin outputs and general wiring information is given in the following figures. Pin outputs are defined in Table 3-7.

NOTE: Refer to the other documentation accompanying your Aerotech equipment. Call your Aerotech representative if there are any questions on system configuration.

NOTE: If you are using your own cables to connect the stage, ensure that motor and ground wires can handle current higher than the continuous motor current listed in Table 3-4. The voltage rating of the wire insulation must be greater than the maximum drive output voltage.

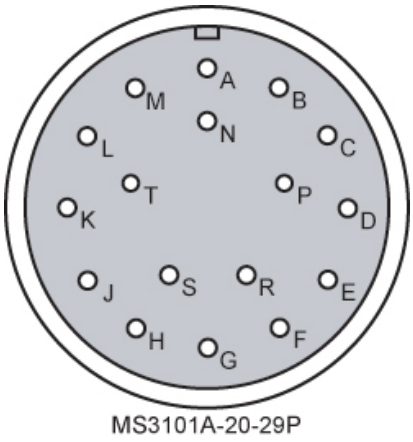


Figure 3-7: Encoder and Brake Wiring For Standard PRO225 Stages

Table 3-5: Feedback Connector Pin Assignment (MS3101A-20-29P)

Pin	Function	Pin	Function
A	Cosine	L	Thermistor
B	Cosine-N	M	Hall Effect B
C	Sine	N	Reserved
D	Sine-N	P	Hall Effect C
E	Marker	R	Reserved
F	Marker-N	S	Brake + (optional)
G	Encoder Common	T	Brake – (optional)
H	Encoder +5v		
J	Shield (no connection to frame)		
K	Hall Effect A		

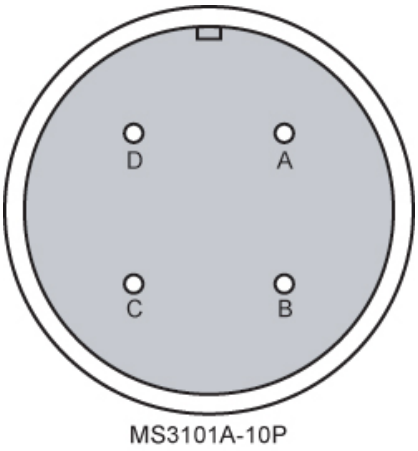


Figure 3-8: Motor Wiring Connector for all PRO225 Stages

Table 3-6: Motor Power Connector Pin Assignment (MS3101A-10P)

Pin	Function
A	Motor Phase A
B	Motor Phase B
C	Motor Phase C
D	Motor Phase Ground
Backshell	Motor Cable Shield

Table 3-7: Feedback Connector Pinout Descriptions

Pin Output	Description
Cosine	Incremental encoder output; either TTL line driven or amplified sine wave type signal.
Cosine-N	Incremental encoder output. Complement of cos.
Encoder +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
Encoder Common	+5 V return for optical encoders (ground).
Hall Effect A	Brushless motor commutation track output. TTL line driven signal with rotary motor.
Hall Effect B	Brushless motor commutation track output. TTL line driven signal with rotary motor.
Hall Effect C	Brushless motor commutation track output. TTL line driven signal with rotary motor.
Marker	Incremental encoder output pulse given once per revolution. Typically used for home reference cycle.
Marker-N	Incremental encoder output; either the compliment of Marker with a line driven, TTL type encoder or 2.5 V DC bias level with amplified sine wave type encoder.
Sine	Incremental encoder output; either TTL line driven or amplified sine wave type signal.
Sine-N	Incremental encoder output. Complement of sin.
Brake +	Brake +24 VDC, 1 A max (optional)
Brake -	Brake 24 VDC Common (optional)
Thermistor	Motor over temperature Thermistor (BMS motor only)
Shield	Feedback cable shield

3.7. Vacuum Operation

Aerotech can specially prepare the PRO225 series stage for operation in vacuum environments. Aerotech offers two vacuum preparation options; one for low vacuum (for use in atmospheric pressures to 10^{-3} torr) and one for high vacuum (preparation for environments from 10^{-3} to 10^{-6} torr). As part of this preparation, attention to detail during modification, cleaning, and assembly results in stages with optimal performance in vacuum applications. This chapter will outline preparation techniques for stages that will operate in a vacuum. Some techniques covered are:

- Lubrication with vacuum–compatible lubricants
- Use of materials, fasteners, and coatings with vacuum outgas performance compatible with the level of vacuum specified
- For high vacuum stages, elimination of situations that may allow gases to become temporarily trapped during pump down
- Extensive cleaning prior to assembly in a clean environment and packaging in a special polyethylene bag

3.7.1. Special Guidelines

To ensure that the stage will continue to perform well in the vacuum environment, follow the guidelines listed below (in addition to standard handling, installation, and lubrication guidelines outlined earlier in this manual).

1. Do not remove the stage from the sealed bag until it is ready for use.
2. Always handle the stage in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the stage.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the stage.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum–compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of Braycote® 602EF grease or a substitute of equal quality.

Baking vacuum components between 100 and 125 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum surfaces and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 4: Maintenance

This chapter will cover information about intervals between lubrications, detail the lubrication and inspection process, and cover which lubricants are recommended for use. Also included is a section on belt tension and adjustment on stages with the foldback option.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. Always operate the stage with the hard cover and side seals in place to help keep dirt out..

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in PRO225 series stages depends on conditions such as duty cycle, speed, and the environment. An inspection interval of once per month is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the bearing surfaces. In general, it is recommended that stages operating in a clean environment be lubricated annually, or every 500 km, whichever comes first. For stages operating under conditions involving excessive debris, lubrication every six months is recommended. If the application process uses only a small portion of travel for most of the duty cycle, it is recommended that the stage be periodically driven through full travel to redistribute the lubrication in the bearings and ballscrew. The ballscrew end bearings and motor bearings are sealed, and should not need to be relubricated under normal use.

4.2. Cleaning and Lubrication

4.2.1. Recommended Cleaning Solvents

For standard ballscrew assemblies and LMG guide rails, THK AFE-CA grease is recommended.

If a solvent is necessary for cleaning the stage, it is recommended that isopropyl alcohol be used. Harsher solvents, such as acetone, may damage the plastic and rubber seals on the ballscrew or LMG trucks. If acetone is required, avoid the screw and bearing seals.

For high-speed applications (i.e., near maximum speed at a duty cycle of 50%), frequent ballscrew maintenance with standard lubricants is required.

4.2.2. Important Notes on Lubrication

When cleaning and/or lubricating components of the PRO225 series stages:

1. Be sure to use a clean, dry, soft, lint–free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the linear motion guides for any damage or signs of wear.
3. In applications that have multiple stages bolted together to form multiaxis systems, the orthogonality may be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.
4. Further disassembly of the stage is not recommended because proper assembly and calibration can only be done at the factory. In addition, a laser interferometer is required for post assembly verification to maintain warranties.

4.2.3. Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow. Before beginning lubrication, see Section 4.2.1. for recommended lubricants.

1. Drive the stage table to one end of travel (Figure 4-1) and remove power to the stage.
2. Remove the screws on the edges of the hard cover (Figure 4-2) and slide it out from the side opposite of the motor (Figure 4-3). This can be done without removing the table.
3. Remove any accumulated dust or debris from the inside of the assembly.
4. Remove any dirty or dried lubricant from the ballscrew. Use a clean, lint-free cloth with a side-to-side motion. Manually turn the ballscrew to clean its entire circumference. A swab soaked in Isopropyl Alcohol may be used to remove stubborn debris.
5. Clean the end of the ballscrew nut and wiper with a clean, lint-free cloth or swab.
6. Clean the linear bearing guides using a similar technique.
7. Apply a thin, continuous film of lubricant to the ballscrew threads and linear bearing guides. A good quality, natural bristle artist's brush makes an excellent applicator.
8. For stages without an optional brake, manually move the stage to the opposite end of travel. This will work the grease into the ballscrew and linear bearing guides. If the stage has an optional brake, the stage cannot be moved by hand. In this case, restore power to the stage, drive it to the desired position, then remove power and continue to Step 9. Be sure to use extreme caution while operating the stage temporarily without the hardcover installed.
9. Repeat steps 3 through 7 for any areas covered by the original table position.

10. Refasten the hardcover.
11. Restore power to the stage; drive the stage table back to its original position to redistribute lubricants.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

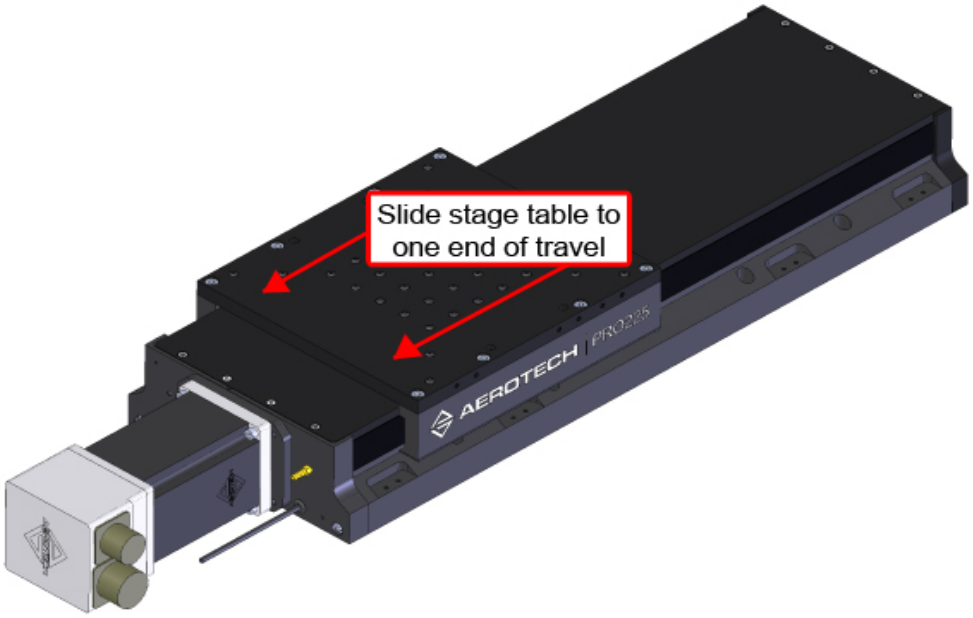


Figure 4-1: Hardcover Removal Procedure (Step 1)

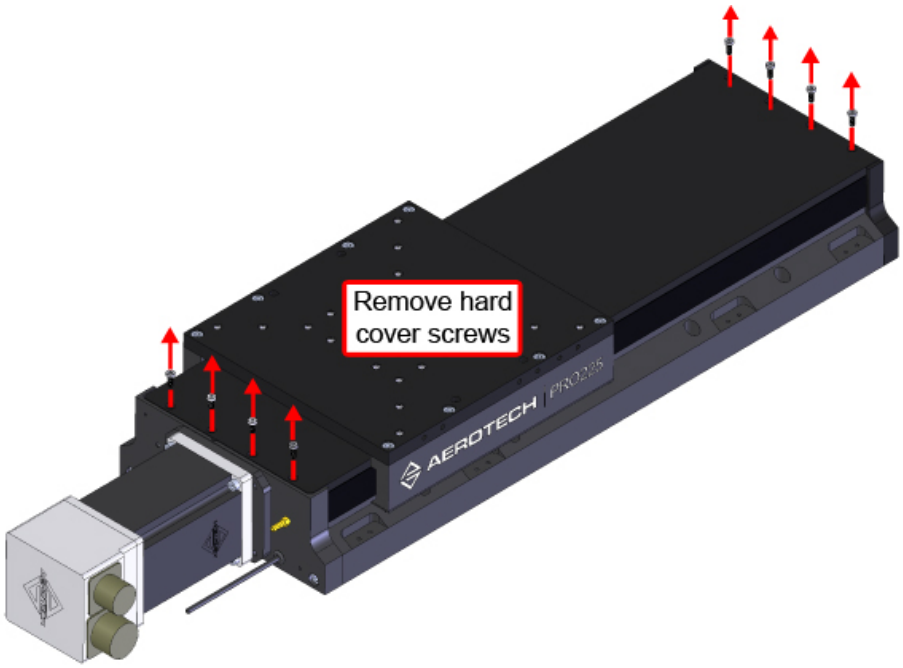


Figure 4-2: Hardcover Removal Procedure (Step 2)

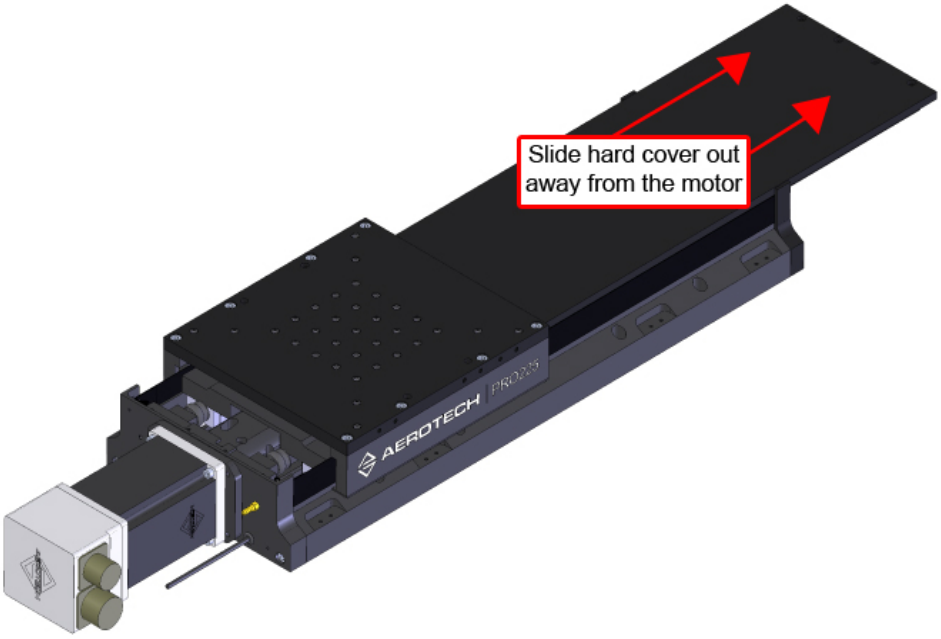


Figure 4-3: Hardcover Removal Procedure (Step 3)

4.3. Belt Adjustment

This section applies only to stages equipped with foldback motor options. On foldback stages, the motor torque is transferred to the ballscrew via a timing belt. Belt tension is critical to stage performance and accuracy.

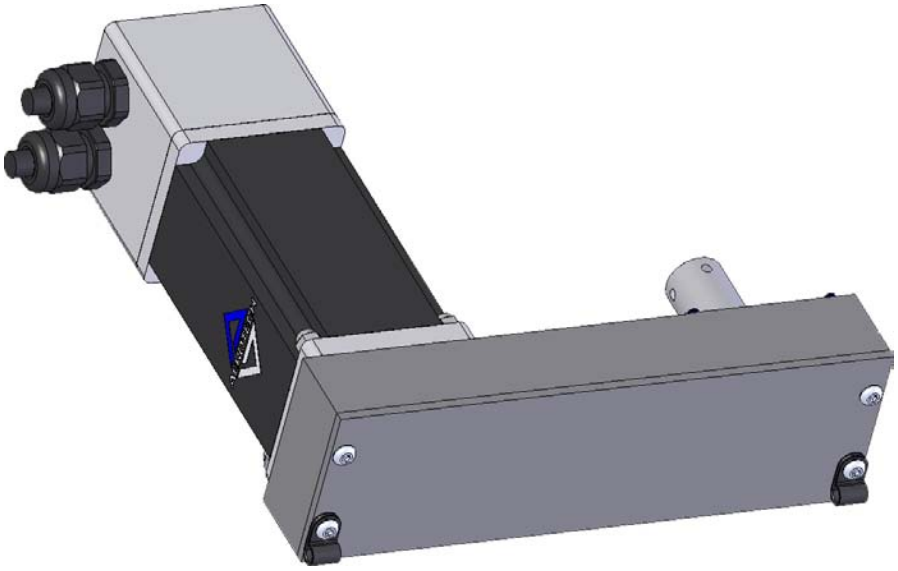


Figure 4-4: Foldback Motor Option Example

When lubricating and cleaning the stage, it is recommended that belt tension be checked. Deflection in the belt should be less than 5 mm when applying a downward force directly between the pulleys (Figure 4-5) of approximately 5 N. If deflection exceeds this range, the belt tension should be adjusted. The method of adjustment is outlined below.

1. Remove power to the stage.
2. Remove the four mounting screws for the foldback cover (Figure 4-5).
3. Check the tension in the belt to determine if adjustment is necessary.
4. If adjustment is required, loosen (but do not remove) the four motor mounting screws (Figure 4-5).
5. The motor mounting holes are slotted to allow for belt adjustment (Figure 4-6). With all four screws loose, pull the motor away from the stage by hand until achieving the necessary belt tension.
6. Tighten motor mounting screws and re-check the tension in the belt. Belt tension may change after the mounting screws are tightened, so if necessary repeat step 5 until desired tension is reached.
7. While adjusting tension, it is advisable to verify that the pulleys are tight on their respective shafts. Each pulley is held in position with two set screws (Figure 4-6). If a pulley is loose, it may be necessary to tighten one or both of these screws.
8. Once tension adjustment is complete, replace the foldback cover and mounting screws. Restore power to the stage.

NOTE: If the stage has been calibrated (HALAR), note the orientation of the two pulleys within regard to each other or recalibration might be required.

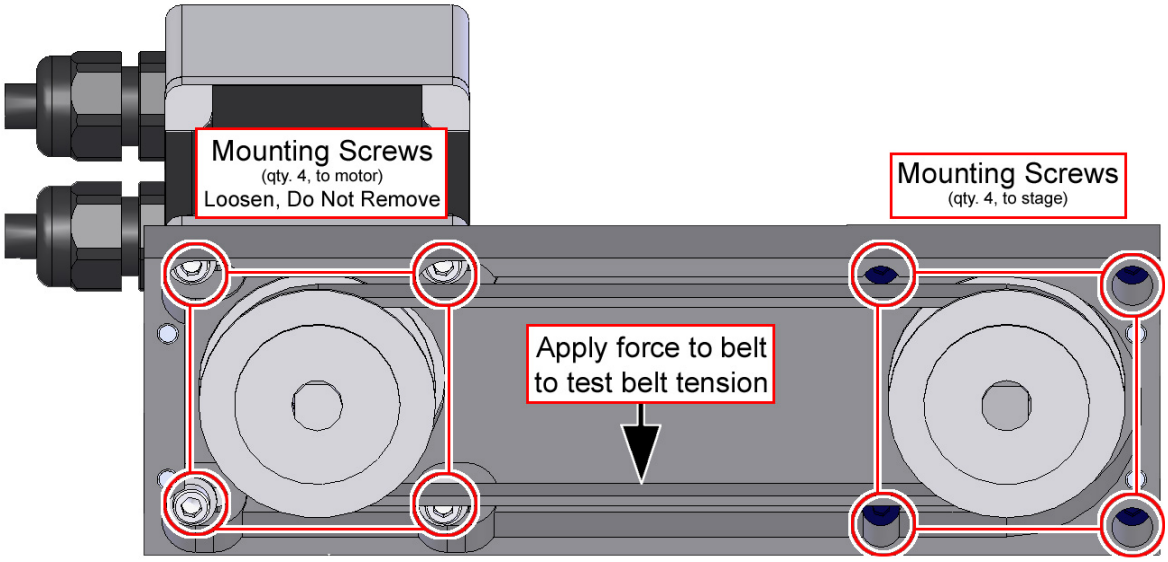


Figure 4-5: Belt Access and Adjustment on Foldback Models (1)

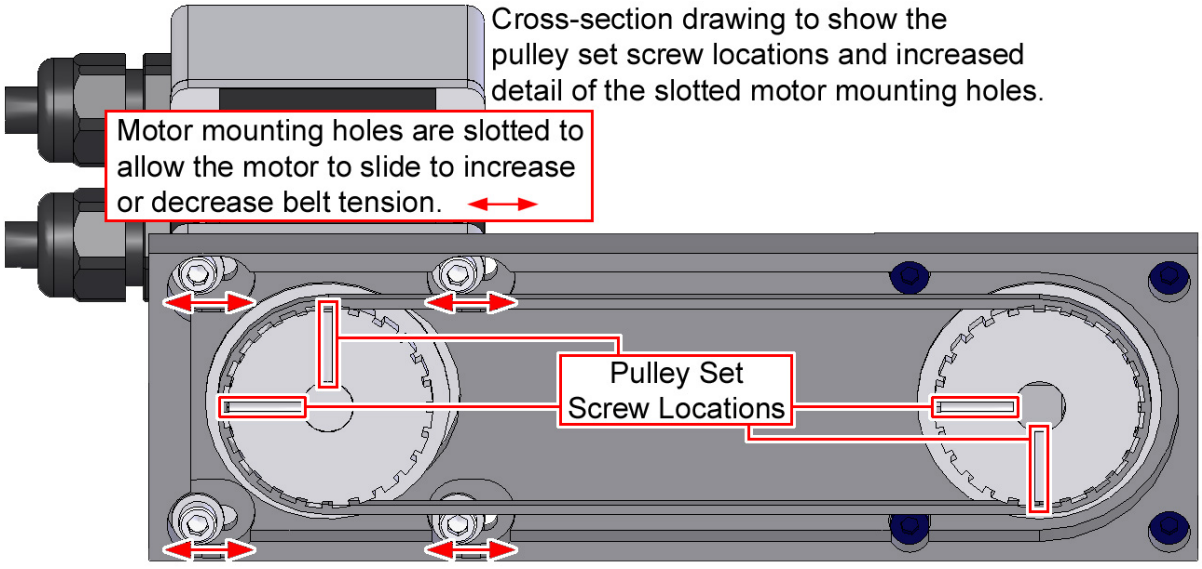

Cross-section drawing to show the
pulley set screw locations and increased
detail of the slotted motor mounting holes.
Motor mounting holes are slotted to
allow the motor to slide to increase
or decrease belt tension.
Pulley Set
Screw Locations

Figure 4-6: Belt Access and Adjustment on Foldback Models (2)

4.4. Lifting Instructions

This section applies only to stages equipped with lifting features. The lifting features should come attached to the system and contain (qty 4) eye bolts and (qty 4) stand-offs. These must be removed before the stage can operate. The eyebolts are threaded into the standoffs and the standoffs are threaded into the stage base. They can be removed by tightening a wrench on the flats of the standoffs (see Figure 4-7). Reverse this process to re-attach the lifting features for future moving. If the stage is part of a multi-axis system, the lifting features should be attached to the lower axis.

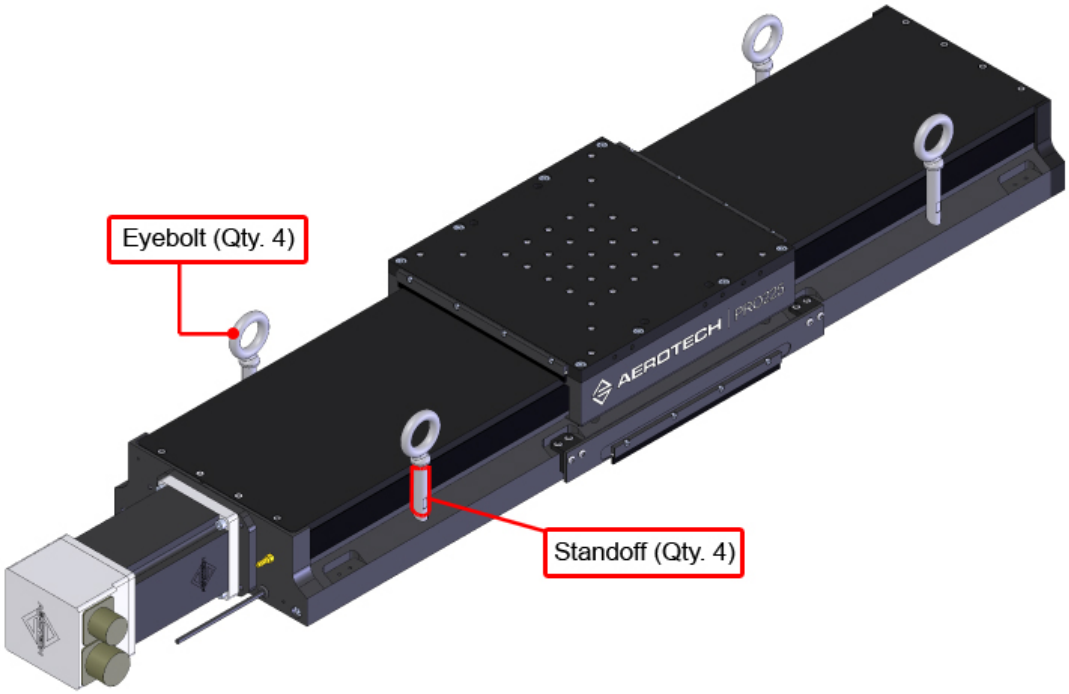


Figure 4-7: Lifting Features

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA
15238-2897

Phone: (412) 963-7470

Fax: (412) 963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.04.00)

Section(s) Affected	General Information
Section 3.5.2.	Added statement about transistor type of limit switch

Table B-2: Archived Changes

Revision	Section(s) Affected	General Information
1.00.00	--	New Manual
1.01.00	Multiple	PRO225 now accepts a NEMA 34 frame motor instead of a NEMA 23.
1.01.00	Multiple	BM250 is now the standard motor for 5mm lead stages. BMS280 is now the standard motor for -HS-25mm stages.
1.01.00	Section 1.1.3.	Updated model numbers
1.01.00	Multiple	New 24V limit and -AGR tabletop options added.
1.01.00	Section 3.3.	Updated accuracy specifications.
1.01.00	Section 1.2.	Dimensions section added
1.01.00	Section 1.1.2.	Toe Clamp Accessory section added
1.02.00	Section 3.3.	Updated Stage Mass specifications
1.03.00	Section 1.2.	Added Tabletop dimensions
1.03.00	Section 3.3.	Added Motor specifications
1.03.00	Section 1.4.	Added Section
1.03.00	Section 3.1.	Added Section
1.03.00	Chapter 2: Installation, Section 2.1. , Section 2.4. , Section 2.6. , Section 3.6. , and Section 1.3.	Added Safety Information and Warnings

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Reader's Comments

PRO225 Series Stage Manual **P/N: EDS134, March 29, 2011** **Revision 1.04.00** Please answer the questions below and add any suggestions for improving this document.	

Is the manual:	Yes	No
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

	Stage/Product Details		Name	
Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

Mail your comments to:	**Fax to:**
Aerotech, Inc. 101 Zeta Drive Pittsburgh, PA 15238 U.S.A.	412-967-6870
	Email:
	service@aerotech.com